

**It is claimed:**

1. A digital imaging apparatus, comprising:

5 an optical sensor capable of converting an object image into a detected image;  
an analog-to-digital converter coupled to the optical sensor, the analog-to-digital converter capable of converting the detected image to digital image information;  
a plurality of computational elements, a first computational element of the plurality of computational elements having a first fixed architecture and a second  
10 computational element of the plurality of computational elements having a second fixed architecture, the first fixed architecture being different than the second fixed architecture;  
and

an interconnection network coupled to the plurality of computational elements and to the analog-to-digital converter, the interconnection network capable of  
15 providing a processed digital image from the digital image information by configuring the plurality of computational elements for performance of a first imaging function of a plurality of imaging functions in response to first configuration information, and by reconfiguring the plurality of computational elements for performance of a second imaging function of the plurality of imaging functions in response to second  
20 configuration information, the first imaging function being different than the second imaging function.

2. The digital imaging apparatus of claim 1, further comprising:

25 focusing means capable of providing the object image to the optical sensor.

3. The digital imaging apparatus of claim 2, wherein the focusing means comprises a focusing assembly, the focusing assembly further comprising: a lens; a shutter; an aperture; and a focusing motor.

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4. The digital imaging apparatus of claim 1, wherein the optical sensor is at least one of a plurality of optical sensors, the plurality of optical sensors comprising: a charge coupled device (CCD), a charge injection device (CID), an optical complementary metal oxide silicon (CMOS) array, an optical bipolar junction transistor (BJT) array, a photogate array, or a photodiode array.
5. The digital imaging apparatus of claim 1, further comprising:  
an analog output interface coupled to the interconnection network, the analog output interface capable of converting the processed digital image to an analog form; and  
a viewfinder screen coupled to the analog output interface, the viewfinder screen capable of visually displaying the analog form of the processed digital image.
6. The digital imaging apparatus of claim 1, further comprising:  
an analog output interface coupled to the interconnection network, the analog output interface capable of converting the processed digital image to an analog form; and  
an analog output port coupled to the analog output interface, the analog output port capable of outputting the analog form of the processed digital image.
7. The digital imaging apparatus of claim 1, further comprising:  
a first memory couplable to the interconnection network, the first memory capable of storing the processed digital image.
8. The digital imaging apparatus of claim 7, wherein the first memory is selectively removable flash memory.
9. The digital imaging apparatus of claim 7, further comprising:  
a second memory coupled to the interconnection network, the second memory capable of storing the first configuration information and the second configuration information.

10.           The digital imaging apparatus of claim 10, wherein the second memory is synchronous dynamic random access memory (SDRAM).
- 5   11.           The digital imaging apparatus of claim 9, wherein the first memory and the second memory are at least one of a plurality of memory types, the plurality of memory types comprising: flash memory, DRAM, SRAM, SDRAM, FeRAM, MRAM, ROM, EPROM and E<sup>2</sup>PROM.
- 10   12.           The digital imaging apparatus of claim 1, further comprising:  
a digital output port coupled to the interconnection network, the digital output port capable of outputting the processed digital image.
13.           The digital imaging apparatus of claim 1, wherein the processed digital  
15 image is provided as a plurality of processed digital image data packets.
14.           The digital imaging apparatus of claim 13, further comprising:  
a digital output interface coupled to the interconnection network, the digital output interface capable of selecting a plurality of processed digital image data  
20 words from the plurality of processed digital image data packets and assembling the plurality of processed digital image data words to form the processed digital image.
15.           The digital imaging apparatus of claim 1, wherein the digital image information is provided as a plurality of digital image information data packets.  
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16.           The digital imaging apparatus of claim 1, further comprising:  
a light source capable of providing light for reflection from an object to form the object image.

17. The digital imaging apparatus of claim 1, further comprising:  
a printer coupled to the interconnection network, the printer capable of  
printing the processed digital image on a tangible medium.
- 5 18. The digital imaging apparatus of claim 1, further comprising:  
a dry copier coupled to the interconnection network, the dry copier  
capable of transferring the processed digital image to a tangible medium.
19. The digital imaging apparatus of claim 1, further comprising:  
10 a data transmitter coupled to the interconnection network, the data  
transmitter capable of transmitting the processed digital image to a remote location.
20. The digital imaging apparatus of claim 18, wherein the data transmitter is  
at least one of the following plurality of data transmitters: an analog (voice band)  
15 modem; a digital modem; a digital subscriber line modem; and a cable modem.
21. The digital imaging apparatus of claim 1, wherein the plurality of imaging  
functions comprises at least two of the following functions: linear filtering; nonlinear  
filtering; morphological filtering; median filtering; local weighted median filtering;  
20 center weighted median filtering; vector weighted median filtering; multichannel image  
recovery; multiframe image restoration; iterative image restoration; motion detection;  
motion estimation; low pass filtering; multirate filtering; wavelet-based multirate  
filtering; autofocus; contrast enhancement; blur removal.
- 25 22. The digital imaging apparatus of claim 1, wherein the first fixed  
architecture and the second fixed architecture are selected from a plurality of specific  
architectures, the plurality of specific architectures comprising at least two of the  
following corresponding functions: linear filtering, non-linear filtering, memory,  
addition, multiplication, complex multiplication, subtraction, synchronization, queuing,  
30 over sampling, under sampling, adaptation, configuration, reconfiguration, control, input,  
output, and field programmability.

23. The digital imaging apparatus of claim 1, wherein the detected image comprises an electrical signal corresponding to brightness and color variations of the object image.

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24. The digital imaging apparatus of claim 1, wherein the digital imaging apparatus is embodied as at least one integrated circuit.

25. The digital imaging apparatus of claim 1, wherein the digital imaging  
10 apparatus is embodied as a digital camera.

26. The digital imaging apparatus of claim 1, wherein the digital imaging apparatus is embodied as one or more of the following: a scanner, a printer, or a dry copier.

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27. A digital imaging apparatus comprising:

- an optical sensor capable of converting an object image into a detected image;
- an analog-to-digital converter coupled to the optical sensor, the analog-to-digital converter capable of converting the detected image to a plurality of digital image information data packets;
- an input pipeline register coupled to the analog-to-digital converter, the input pipeline register capable of receiving the plurality of digital image information data packets;
- a first memory capable of storing the plurality of digital image information data packets;
- a hardware task manager capable of processing a plurality of imaging tasks and determining that a first imaging task from the plurality of imaging tasks is capable of being performed and that a second imaging task from the plurality of imaging tasks is capable of being performed, the first imaging task being different than the second imaging task;
- a data distributor coupled to the input pipeline register, to the first memory, and to the hardware task manager, the data distributor capable of distributing the plurality of digital image information data packets to the first memory;
- an adaptive execution unit coupled to the hardware task manager and to the first memory, the adaptive execution unit capable of configuring to perform the first imaging task and capable of performing the first imaging task using the plurality of digital image information data packets, the adaptive execution unit further capable of reconfiguring to perform the second imaging task and capable of performing the second imaging task, the adaptive execution unit further capable of generating a corresponding plurality of processed digital image data packets from the performance of the first imaging task and the second imaging task;
- a data selector coupled to the hardware task manager, to the adaptive execution unit and to the first memory, the data selector capable of determining routing for the corresponding plurality of processed digital image data packets; and

an output pipeline register coupled to the data selector, the output pipeline register capable of receiving the corresponding plurality of processed digital image data packets.

5     28.             The digital imaging apparatus of claim 27, wherein the adaptive execution unit comprises:

                 a plurality of computational elements, a first computational element of the plurality of computational elements having a first fixed architecture and a second computational element of the plurality of computational elements having a second fixed  
10     architecture, the first fixed architecture being different from the second fixed architecture;

                 a plurality of switching elements coupled to the plurality of computational elements, the plurality of switching elements capable of configuring the plurality of computational elements for performance of a first imaging function of a plurality of imaging functions in response to first configuration information, and the plurality of  
15     switching elements further capable of reconfiguring the plurality of computational elements for performance of a second imaging function of the plurality of imaging functions in response to second configuration information, the first imaging function being different than the second imaging function.

20     29.             The digital imaging apparatus of claim 28, wherein the plurality of switching elements are comprised of a plurality of multiplexers, a plurality of demultiplexers, and a plurality of routing elements.

30. The digital imaging apparatus of claim 27, wherein the input pipeline register is capable of receiving the plurality of digital image information data packets, each digital image information data packet of the plurality of digital image information data packets containing a plurality of fields, the plurality of fields comprising a first data field for routing information; a second data field for security information; a third data field for a service code, the service code designating an acknowledgement message, a memory read, a memory write, a memory move, or a memory address; a fourth data field for an auxiliary code having a task designation; and a fifth data field for a digital image information data word.

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31. The digital imaging apparatus of claim 27, wherein the hardware task manager is further capable of producing a task queue of a plurality of imaging tasks for execution by the adaptive execution unit.

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32. The digital imaging apparatus of claim 27, further comprising:  
focusing means capable of providing the object image to the optical sensor.

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33. The digital imaging apparatus of claim 32, wherein the focusing means comprises a focusing assembly, the focusing assembly further comprising: a lens; a shutter; an aperture; and a focusing motor.

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34. The digital imaging apparatus of claim 27, wherein the optical sensor is at least one of a plurality of optical sensors, the plurality of optical sensors comprising: a charge coupled device (CCD), a charge injection device (CID), an optical complementary metal oxide silicon (CMOS) array, an optical bipolar junction transistor (BJT) array, a photogate array, or a photodiode array.



35. The digital imaging apparatus of claim 27, further comprising:  
an analog output interface coupled via an interconnection network to the  
output pipeline register, the analog output interface capable of converting the plurality of  
processed digital image data packets to an analog form of a processed digital image; and  
5 a viewfinder screen coupled to the analog output interface, the viewfinder  
screen capable of visually displaying the analog form of the processed digital image.

36. The digital imaging apparatus of claim 27, further comprising:  
an analog output interface coupled via an interconnection network to the  
10 output pipeline register, the analog output interface capable of converting the plurality of  
processed digital image data packets to an analog form of a processed digital image; and  
an analog output port coupled to the analog output interface, the analog  
output port capable of outputting the analog form of the processed digital image.

15 37. The digital imaging apparatus of claim 27, further comprising:  
a light source capable of providing light for reflection from an object to  
form the object image.

38. The digital imaging apparatus of claim 27, further comprising:  
20 a digital output interface coupled to the output pipeline register, the digital  
output interface capable of selecting a plurality of processed digital image data words  
from the plurality of processed digital image data packets and assembling the plurality of  
processed digital image data words to form a processed digital image.

25 39. The digital imaging apparatus of claim 38, further comprising:  
a second memory couplable via an interconnection network to the digital  
output interface, the second memory capable of being selectively removable, the second  
memory capable of storing the processed digital image.

40. The digital imaging apparatus of claim 38, further comprising:  
a digital output port coupled to the digital output interface, the digital output port capable of outputting the processed digital image.
- 5 41. The digital imaging apparatus of claim 40, further comprising:  
a printer coupled to the digital output port, the printer capable of printing the processed digital image on a tangible medium.
42. The digital imaging apparatus of claim 40, further comprising:  
10 a dry copier coupled to the digital output port, the dry copier capable of transferring the processed digital image to a tangible medium.
43. The digital imaging apparatus of claim 40, further comprising:  
a data transmitter coupled to the digital output port, the data transmitter  
15 capable of transmitting the processed digital image to a remote location.
44. The digital imaging apparatus of claim 27, further comprising:  
a digital output port coupled to the output pipeline register, the digital output port capable of selecting a plurality of processed digital image data words from the  
20 plurality of processed digital image data packets and assembling the plurality of processed digital image data words to form a processed digital image, the digital output port further capable of outputting the processed digital image.
45. The digital imaging apparatus of claim 27, wherein the plurality of  
25 imaging tasks provide for performance of at least two of the following functions: linear filtering; nonlinear filtering; morphological filtering; median filtering; local weighted median filtering; center weighted median filtering; vector weighted median filtering; multichannel image recovery; multiframe image restoration; iterative image restoration; motion detection; motion estimation; low pass filtering; multirate filtering; wavelet-based  
30 multirate filtering; autofocus; contrast enhancement; blur removal.

46. The digital imaging apparatus of claim 27, wherein the digital imaging apparatus is embodied as at least one integrated circuit.

47. The digital imaging apparatus of claim 27, wherein the digital imaging  
5 apparatus is embodied as a digital camera.

48. The digital imaging apparatus of claim 27, wherein the digital imaging apparatus is embodied as one or more of the following: a scanner, a printer, or a dry copier.

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49. A digital imaging apparatus, comprising:  
focusing means capable of providing an object image;  
an optical sensor capable of converting the object image into a detected  
image;

5 an analog-to-digital converter coupled to the optical sensor, the analog-to-digital converter capable of converting the detected image to a plurality of digital image information data packets;

a plurality of computational elements, a first computational element of the plurality of computational elements having a first fixed architecture and a second

10 computational element of the plurality of computational elements having a second fixed architecture, the first fixed architecture being different than the second fixed architecture;

an interconnection network coupled to the plurality of computational elements and to the analog-to-digital converter, the interconnection network capable of providing a plurality of processed digital image data packets from the plurality of digital  
15 image information data packets by configuring the plurality of computational elements for performance of a first imaging function of a plurality of imaging functions in response to first configuration information, and by reconfiguring the plurality of computational elements for performance of a second imaging function of the plurality of imaging functions in response to second configuration information, the first imaging function  
20 being different than the second imaging function;

a digital output interface coupled to the interconnection network, the digital output interface capable of selecting a plurality of processed digital image data words from the plurality of processed digital image data packets and assembling the plurality of processed digital image data words to form a processed digital image.

25 50. The digital imaging apparatus of claim 49, wherein the optical sensor is at least one of a plurality of optical sensors, the plurality of optical sensors comprising: a charge coupled device (CCD), a charge injection device (CID), an optical complementary metal oxide silicon (CMOS) array, an optical bipolar junction transistor (BJT) array, a  
30 photogate array, or a photodiode array.

51. The digital imaging apparatus of claim 49, further comprising:  
an analog output interface coupled to the interconnection network, the analog output interface capable of converting the processed digital image to an analog form;

5 a viewfinder screen coupled to the analog output interface, the viewfinder screen capable of visually displaying the analog form of the processed digital image;  
an analog output port coupled to the analog output interface, the analog output port capable of outputting the analog form of the processed digital image; and  
a digital output port coupled to the interconnection network, the digital  
10 output port capable of outputting the processed digital image.

52. The digital imaging apparatus of claim 49, wherein the plurality of imaging functions comprises at least two of the following functions: linear filtering; nonlinear filtering; morphological filtering; median filtering; local weighted median  
15 filtering; center weighted median filtering; vector weighted median filtering; multichannel image recovery; multiframe image restoration; iterative image restoration; motion detection; motion estimation; low pass filtering; multirate filtering; wavelet-based multirate filtering; autofocusing; contrast enhancement; blur removal.

20 53. The digital imaging apparatus of claim 49, wherein the first fixed architecture and the second fixed architecture are selected from a plurality of specific architectures, the plurality of specific architectures comprising at least two of the following corresponding functions: linear filtering, non-linear filtering, memory, addition, multiplication, complex multiplication, subtraction, synchronization, queuing,  
25 over sampling, under sampling, adaptation, configuration, reconfiguration, control, input, output, and field programmability.

54. The digital imaging apparatus of claim 1, wherein the digital imaging apparatus is embodied as a digital camera.

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